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ABSTRACT

This module on the automotive electrical system is the fourth of six (CE 028 296-301) in the auto mechanics course of a bilingual skills training program (A Vocabulary Development Workbook is available as CE 028 294.) The course is designed to furnish theoretical and laboratory experience. Module objectives are for students to develop trade-related Spanish/English vocabulary; to describe the basics of electricity; to name the five main groups making up the automotive electrical system; to describe the parts and functions of the battery, starting motor, and charging system; and to name the most common problems of the electrical system. Contents include list of module objectives; pretest; six sections on (1) auto electrical system, (2) its parts, (3) battery, (4) starting motors, (5) charging system, and (6) problems of the electrical system; posttest; and English/Spanish vocabulary list. Each section is organized into this format: instructions, vocabulary, and concepts (statements or questions to direct reading) presented in English and Spanish; readings; and worksheets to evaluate comprehension of the trade-related reading material. Worksheets also cover these areas: vocabulary, definitions, word attack skills, spelling, writing skills, and application of terminology to the trade area. (YLB)

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I. PURPOSE

This module is to:

1. Assist students in developing trade-related vocabulary.

2. Facilitate the learning of the trade through reading information sheets, vocabulary lists and language exercises.

3. Provide student with individual check lists for individual progress.

II. INTRODUCTION

Auto Mechanics requires the student to follow a defined theoretical course of study as well as acquire practical knowledge in the respective trade. Due to the limited amount of time allowed for theory and the difficulty of the technical vocabulary found in the reading, the student often needs additional help in this area. Students in the Auto Mechanics trade are required to pass periodical tests and a final review before receiving a certificate allowing them to practice their trade. To succeed in passing this exam and to be better equipped for the job, the student must be able to function in the oral and written communication skills and utilize the technical vocabulary of their trade. This module is structured to provide for individual needs of the students so that they may progress at their pace in theacademic or theoretical area. A simple coding system is utilized to facilitate student use.

III. ACTIVITIES

Because each module is geared for individualized instruction it is important to assess the individual needs of the students. A pre-test is administered to students before they begin working with a module. Instructions are given orally in Spanish and English.

Instructions, vocabulary and concepts in each module are written in Spanish and English so as to explain the purpose of each reading. There is a reading for each objective presented in the module. The reading is referred to as an information sheet. This sheet is designed to provide the student with reading material incorporating the technical vocabulary that is needed in the trade skill area. The gradation of reading is from simple to more complex. Thus the information sheet facilitates the learning process in the theoretical course of study. Each information sheet is followed by a series of diversified work sheets directly checking for comprehension of the reading material. Other items covered in these work sheets are: vocabulary, definitions, work attack skills, writing skills, spelling and application of terminology to the trade area.

Oral language development exercises directed by the instructor constantly reinforce the concepts presented. Students have an opportunity to utilize and develop the technical vocabulary needed in their trade by interaction among themselves, the instructor and tutors. The Bilingual dimension is specifically directed at concept and vocabulary development.

The students are directed to utilize supplementary materials available through the Learning Resource Center to reinforce each area as they progress in the module. Audio visuals are utilized to introduce subject matter. They are also accessible to the students to be used on an individual basis.

IV. EVALUATION

The students are evaluated by the instructors as to their progress in language and in the course content area through the pre-test, work sheets, check list and a post test. Individual student profiles and folders are kept on record to check on student progress at all times. Oral development skills are assessed individually.

Students go through the following process in utilizing the modules:

Pre-test (Students scoring 85% or below must complete the entire module. Those scoring above 85% may go on to the next module.)

Reading of instruction sheet
Information Sheet
Series of written and oral exercises
Oral evaluation
Post test (oral and written)
Recycling, if needed (Students scoring 85% or below on post-test are recycled through module in designated weak areas. See coding system.)

V. MODULE OUTLINE

4.0 The Automotive Electrical System

4.1 The Auto Electrical System

4.2 Parts of the Automotive Electrical System

4.3 The Battery

4.4 Starting Motors

4.5 The Charging System

4.6 Problems of the Electrical System

STUDENT OBJECTIVES

Upon completion of this module the students will be able to:

4.1 Describe in detail the basics of electricity.

4.1.1 Recognize, use and define vocabulary related to basic electricity.

4.2 Name the five main groups that make up the auto electrical system.

4.2.1 Name the function of each of the five main groups of the electrical system.

4.2.2 Recognize, use and define the vocabulary related to the parts of an auto electrical system.

4.3 Describe and explain the parts and function of the battery.

4.3.1 Explain how electrolyte is produced.

4.3.2 Name the four battery checks that must be done regularly.

4.3.3 Recognize, use and define vocabulary related to battery.

4.4 Describe the parts and function of the starting motor.

4.4.1 Recognize, use and define vocabulary related to starting motor.

4.5 Describe the function of the charging system.

4.5.1 Name the parts and function of each of the parts that make up the charging system.

4.5.2 Recognize use and define vocabulary related to the charging system.

4.6 Name the most common problems of the electrical system

4.6.2 Name the six steps for rebuilding a starting motor.

4.6.3 Name the three most common problems for the charging system.

4.6.4 Name the remedies that will correct the problems.

PRE-TEST

1. Describe how electricity is produced.

2. How and what is used to measure electricity?

3. Name the five groups that make up the electrical system.

4. What three jobs must the electrical system do?

5. What are the four battery checks you must make regularly?

6. What is electrolyte and what must you do if you get it on your skin?

7. What are the two major parts of a starting motor?

8. What is the function of the starting motor?

9. What is the charging system made up of?

10. What are AC and DC?

11. Name the six major steps for rebuilding a starting motor.

12.. Name the three common problems of a charging system.

Instructions:

In the following information sheet you will read about the Auto Electrical Systems. This reading will give you some basic information so that you will better understand the electrical system in a car. There is a vocabulary list on words introduced in the reading. Check each word carefully before proceding to read the article.

Instrucciones:

En la siguiente página de información vas a leer del sistema eléctrico del auto. Esta lectura te dará información básica para que mejor comprendas el sistema eléctrico de un automóvil. Hay una lista de vocabulario que se presenta en la lectura. Lee cada palabra cuidadosamente antes de leer el artículo.

Vocabulary

electricity = movement of electron particles.
electricidad = movimiento de substancía electrónica.

electron = basic unit of electricity.
electron = unidad básica de electricidad.

amperes = electrical measurement.
amperio = unidad de medida de corriente eléctrica.

particles = the smallest portion of something.
partículo = porción mas pequeña de alguna cosa.

volts = measurement of electrical pressure.
voltios = medida de presión eléctrica.

resistance = limiting amount of electron flow.
resistencia = limitar la cantidad de la corriente de electrones.

ohms = measurement of electrical resistance.
ohmio = medida de resistencia eléctrica.

Remember the following questions as you read the information.

Recuerda las siguientes preguntas al leer la información.

1. How is electricity produced?
   ¿Cómo se produce la electricidad?

2. How is electricity measured?
   ¿Cómo se mide la electricidad?

3. What is electrical pressure?
   ¿Qué es presión eléctrica?

4. What is resistance?
   ¿Qué es resistencia?

1. In order to understand the electrical system in a car, it is important to know the basics of electricity. Electricity is made up of billions of tiny particles called electrons. When electrons move in one direction in a wire, an electric current is produced.

2. Electricity is measured in amperes or amps. The meter that measures electricity is called an ammeter. The flow of electrons on a wire or electricity is measured by an ammeter by the use of a magnet. There are two types of magnets, natural magnets and electromagnets. Two (2) important facts to remember about magnets are that (1) magnets can produce electricity, (2) electricity can produce magnets.

3. As mentioned before, in order to have electricity there must be a flow of electrons on a wire. But what makes the electrons move? It is too many electrons in one spot. The battery and the alternator concentrate electrons at one terminal and take them away from the other. So if the two terminals are connected with a wire or conductor, electrons will flow from the terminal that has too many electrons to the terminal that has too few.

4. When we have a great many electrons on one terminal and a great shortage of electrons on another terminal, we say that the electrical pressure is high. This electrical pressure is measured in volts. Car batteries are 12 volt units and are considered low pressure. Sometimes it is necessary to keep electrons from flowing from one point to another. At other times it is necessary to let just a few electrons flow from one point to another. This is called resistance. Resistance is measured in ohms. A small wire used as a conductor has a higher resistance than a large wire used as a conductor. Also the longer the wire is the more

resistance; the shorter a wire is the less resistance. Resistance and its effects will be discussed in a later reading.

5. The relationship between amperes (electron flow), voltage (electrical pressure) and resistance can be summed up in a formula called Ohms Law. The Ohms Law formula is: Voltage is equal to amperage times ohms.

6. In order for electricity to flow, there must be a complete path or circuit. Electrons must flow from one terminal of the battery or alternator through the circuit and back to the other terminal. In a car the engine and frame are used as the return circuit from the electrical device back to the other terminal. This eliminates having to run wires from every electrical device such as lights back to the battery. This return circuit is called a ground. The ground is indicated in wiring diagrams by the use of an arrow with the head composed of three horizontal lines as shown:

7. In the next information sheet you will read about the parts of the Automotive Electrical System.

Find The Answers

1. Electricity is made up of tiny particles called

   A. Electromagnets
   B. Electrons
   C. Volts
   D. Ohms

2. The word in paragraph 2 which means "something that attracts" is _____.

3. The words "measured in ohms" in paragraph 3 refer to _____.

4. Electrical pressure is measured in amps.

   Yes No Does not say

5. On the whole this story is about

   A. Ohms Law
   B. The basics of electricity
   C. Magnets that produce electricity

6. The story does not say so, but it makes you think that

   A. The engine and frame in a car are considered the ground.
   B. Resistance measures amperes.
   C. Large wires have a higher resistance.

7. Why must there be a complete path or circuit?

   A. In order for electricity to flow.
   B. In order for magnets to be produced.

Circle the correctly spelled word in each line.

1.	lectricity	electricity	electrik
2.	ampers	amperes	ampurs
3.	presher	pressure	preshure
4.	voltes	voltse	volts
5.	ohms	ohmes	omes
6.	rezistance	resistance	resestance
7.	particels	partecles	particles
8.	electrons	elecktrons	elestrans
9.	magnats	magnets	magnetes
10.	ground	grounde	grownd

Answer The Following:

1. What are the two types of magnets?

2. How is electricity measured?

3. What makes electrons move?

4. When is electrical pressure high?

5. What is the Ohms Law Formula?

True or False

_____1. There are three types of magnets.

_____2. The return circuit is called a ground.

_____3. Amperage times ohms = voltage.

_____4. Magnets produce electrical pressure.

_____5. Electricity is made up of electrons.

_____6. Car batteries are considered high pressure.

_____7. Resistance is measured in ohms.

_____8. Wires are used as conductors.

_____9. Electrical pressure is measured in amps.

_____10. An ammeter measures resistance.

Choose the correct word or words to complete the statements.

Electricity	ammeter	engine	frame
resistance	amperes	electromagnets	
ground	natural magnets	voltage	

1. The _____and _____of a car are used as a ground.

2. _____is equal to amperage times ohms.

3. The meter for measuring electricity is an _____.

4. _____ is made up of billions of tiny particles.

5. The two types of magnets are _____ _____and _____.

6. The return circuit is called a _____.

7. _____ is measured in ohms.

8. Electricity is measured in _____.

Instructions:

In the following information sheet you will read about the parts of an automotive electrical system. There is also a vocabulary list that will help you understand the information.

Instrucciones:

En la siguiente página de información vas a leer de las partes que tiene un sistema eléctrico automotriz. También encontrarás una lista de vocabulario que te ayudará a entender la información.

components = parts that make up another.
componente = partes que coponen a otra cosa.

charge = amount of electrical strength.
carga = cantidad de fuerza eléctrica.

ignition = to ignite or spark.
ignición = encender.

crank = cause movement.
retación = causar movimiento.

light = illuminate.
luz = iluminar

Remember the following questions as you read the article.

Recuerda las siguientes preguntas al leer el artículo.

1. What are the five systems that make up the electrical system?
   ¿Cuales son los cinco sistemas que tiene el sistema eléctrico?

2. What jobs must the electrical system do?
   ¿Cuales son las funciones que debe hacer el sistema eléctrico?

Since you are familiar with the basics of electricity, we will now discuss the components of the automotive electrical system. The electrical system in a car does several jobs. It starts the engine when the switch is turned on. It makes the sparks that ignite the compressed air-fuel mixture. It operates the lights, the electric gauges and the radio.

There are five (5) main groups of units called systems in the electrical system. They are as follows:

1. The charging system including the battery.
2. The ignition system.
3. The cranking system.
4. The lighting system.
5. The horn system.

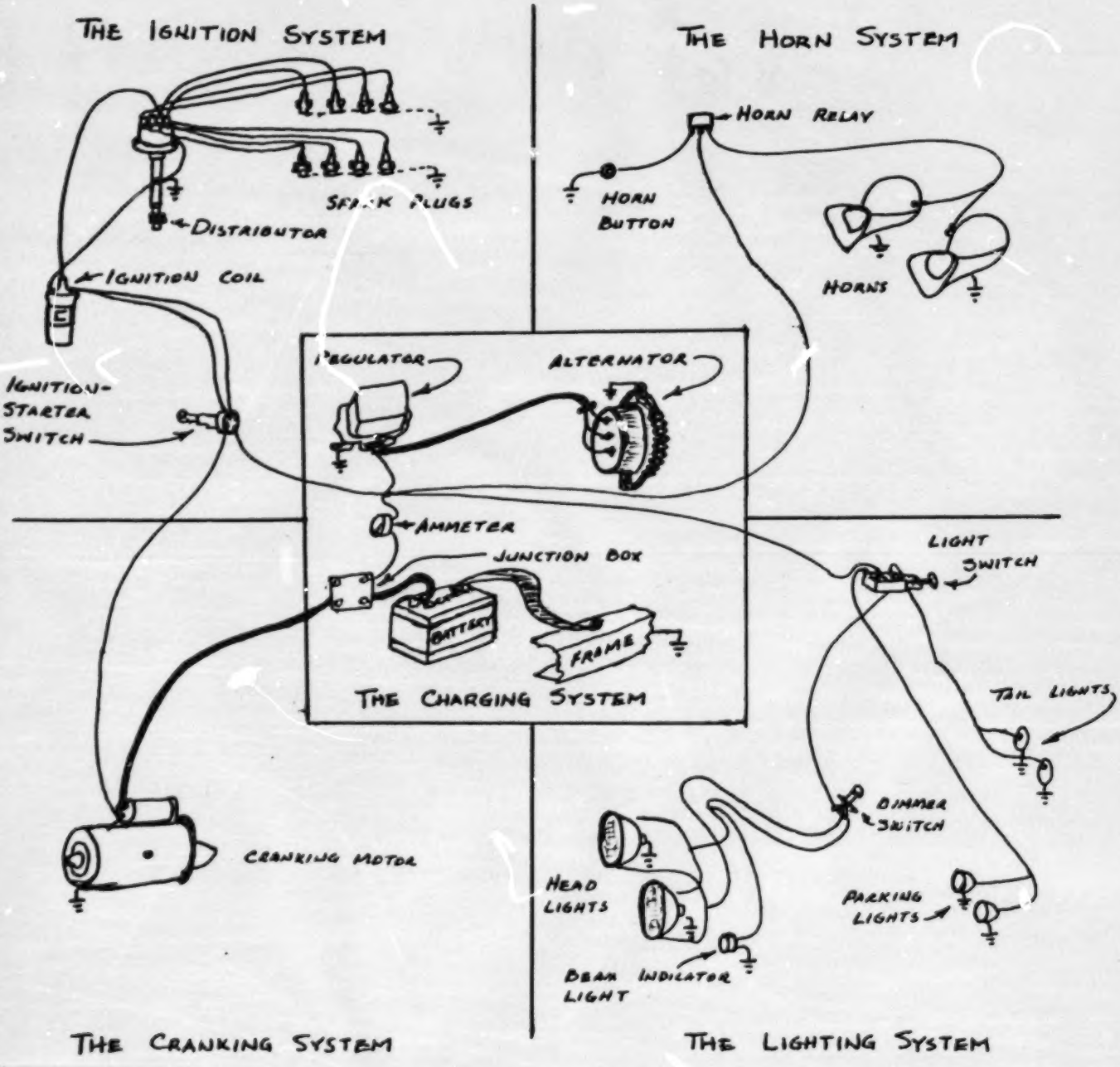
These systems are connected to each other directly or indirectly with wires.

1. The charging system. The charging system in a car is composed of the battery, the voltage regulator, the alternator or generator and the frame and motor of the car. The frame and motor are used as ground (⏚).
2. The ignition system. As you should know from the previous module (2.0), the ignition system of a car is composed of the ignition starter switch, the ignition coil, the distributor and the spark plugs.
3. The cranking system. The cranking or starting system of a car consists of the cranking motor or starter.
4. The lighting system. The lighting system consists of the light switch, headlights, parking lights, tail lights and dimmer switch.
5. The horn system. The horn system consists of a horn relay, a horn button and the horns.

The following diagram shows the auto electrical system including all the parts. Study the diagram thoroughly so you will be well acquainted with this system. Remember that to be a good mechanic you must start with the basic units and know these well. If there is something which you don't understand be sure to ask the instructor for assistance.

In the next information sheet you will read about the battery.

The Automotive Electrical System



Find The Answers

1. How many systems are there in an automotive electrical system?

   A. One
   B. Six
   C. Five
   D. Three

2. The word in paragraph 1 which means "a group of units" is _____.

3. The words in paragraph 1 "starts the engine" refer to _____.

4. The story does not say so, but it makes you think that;

   A. The auto electrical system is very important.
   B. The auto electrical system is responsible for the lights only.
   C. The auto electrical system is responsible for timing the power strokes.

5. The auto elelctrical system is responsible for performing one function.

   Yes No Does not say

6. When the switch is turned on it;

   A. Turns the lights on.
   B. Ignites the air fuel mixture.
   C. Starts the engine.

7. The charging system consists of the;

   A. Starter or cranking motor.
   B. Lights, dimmer and tail lights.
   C. Battery, regulator and alternator.

Circle the correct word.

1. (There, Their) are five systems that make up the electrical system.
2. (This, These) systems are connected to each other.
3. The lighting system consists (of, off) the lights.
4. In the next information sheet you will (read, reed) about the battery.
5. The charging system (in, on) a car is composed of the battery regulator and alternator.
6. Study the diagram so that you (well, will) be (well, will) acquainted with (this, these) system.

Fill in the blanks

c__a__gi__g	d__m__e__
i__n__ti__n	s__s__em
c__a__k__ng	g__a__es
di__gr__m	e__e__tr__c__l
__o__n	c__m__r__s__ed

Circle the correctly spelled word.

diagraph	diagram	diagran
teal	teil	tail
electricity	electrcity	elactricaty
ignicion	ignition	ingnition
generater	generator	genarator
alterator	alternater	alternator
batery	battery	battary
sistam	sistom	system

True or False

_____1. The charging system is composed of only the battery.

_____2. The horn system is composed of the horn relay, horn button and lights.

_____3. The cranking system is made up of the generator, regulator and battery.

_____4. The ignition system supplies the electricity to the lights.

_____5. In the next information sheet you will read about the battery.

Instructions:

In the following article you will read about the battery. There is also a vocabulary list to help you understand the information better.

Instrucciones:

En el siguiente artículo vas a leer de el acumulador (batería). También encontrarás una lista de vocabulario que te ayudará a entender la información mejor.

Vocabulary

battery = a group of energy cells that produce electric current.
acumulador = un grupo de células que producen corriente eléctrica.

electrolyte = chemical produced by mixing water and sulfuric acid.
electrolito = químico producido cuando mesclan agua y ácido sulfúrico.

sulfuric acid = a chemical used for making electrolyte.
sulfúrico = un químico que se usa para hacer electrolito.

Remember the following questions as you read the article.

Recuerda las siguiente preguntas al leer el artículo.

1. What is the heart of an auto electrical system?
   ¿Qué es el corazón de un sistema eléctrico automotriz?

2. What is electrolyte?
   ¿Qué es electrolito?

3. What four things must you check for to avoid battery trouble?
   ¿Qué cuatro cosas tienes de inspectar para evitar problemas con el acumulador?

1. The battery is the heart of an electrical system in an automobile. It is very important to check the battery regularly and keep water in it and keep the posts or terminals clean. The 12 volt automobile battery has a series of six (6) cells in the battery case. Each cell produces 2 volts. Each cell has a number of battery plates with separators between them. The liquid that is produced when water is poured into the cells is called electrolyte. Electrolyte is made up of water and sulfuric acid.

2. When a battery runs down or goes "dead" it is because the sulfuric acid gradually goes into the plates when the electric current is taken out of the battery. When this happens, the electrolyte gets weaker and the battery runs down. The battery then has to be recharged with a battery charger.

3. As was mentioned before, the battery is the heart of a car's electrical system. That is why battery failure is one of the more common car troubles. The four (4) battery checks you should make regularly are:

    1. Check the electrolyte level.
    2. Add water if the electrolyte level is low.
    3. Clean off corrosion around the battery terminals.
    4. Check the battery condition with a testing instrument.

4. It is important to remember that the sulfuric acid in a battery is harmful. It can give you serious skin burns. If it gets in your eyes, it can cause blindness. Sulfuric acid will eat holes in clothing, make spots on car paint, and corrode any metal it touches.

5. If you get battery acid on your skin, flush it off at once with plenty of water. Then put baking soda if available on the burned area. Baking soda neutralizes the acid. If you get acid in your eyes, flush your eyes with water over and over again. Get to a doctor at once.

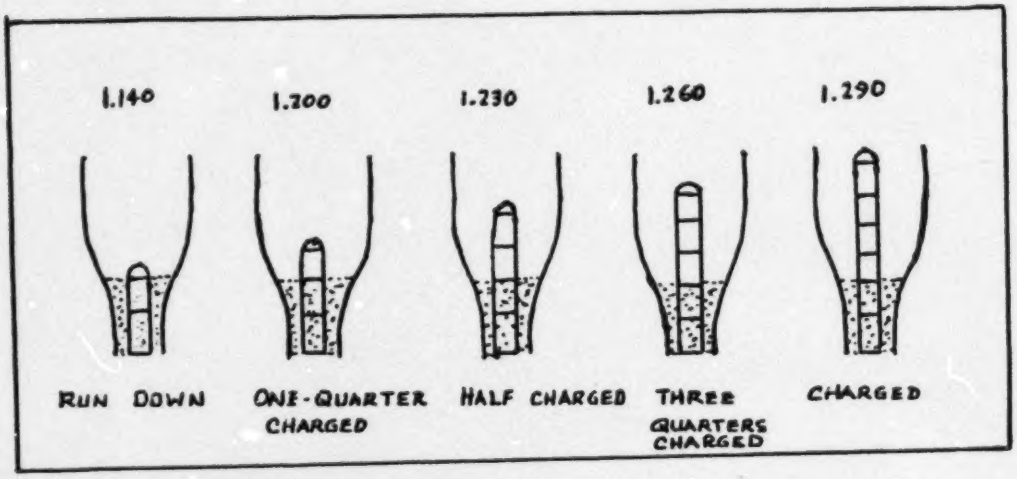
6. There are several types of tests that can be made to find the conditions of a battery. The most common is the hydrometer test. The hydrometer measures the specific gravity of battery electrolyte.

7. The stem of the hydrometer has readings on it. From these readings, as shown in the following drawing, the specific gravity of the electrolyte will indicate if the battery is run down, partly charged or fully charged. As the diagram indicates, the lower the number the weaker the battery is. The other two (2) tests are meter tests. They require the use of a voltmeter to perform the test.

8. The 4-2-1 test is done with a battery tester which performs various functions that are somewhat complicated. The battery tester first applies a discharge load on the battery for a specific number of seconds. The battery tester gives the battery a short charge for a few seconds. Finally, the battery voltage is measured. The tester does all this automatically. The results on the meter tell whether the battery is in good condition, needs charging, or is defective and should be replaced.

9. The cadmium tip test is done with a meter that indicates the condition of the electrolyte by inserting the tips of the tester into the cells. The meter gives a voltage reading that tells you the condition of the cells.

10. One last thing to remember about batteries is that the positive (+) post or terminal is always larger than the negative (-) terminal. The next information sheet will explain the starting motor.



Various specific gravity readings using a Hydrometer.

Find The Answers

1. The heart of an auto electrical system is;

   A. The generator
   B. The regulator
   C. The battery

2. The words in paragraph 1 which mean "keeps apart" is _____.

3. The word "dead" in paragraph 2 refers to _____.

4. The story does not say so, but it makes you think that;

   A. The battery is only as good as the care you put into it.
   B. The battery is always causing problems.
   C. The battery can be recharged with water.

5. When you mix water and sulfuric acid you make;

   A. baking soda.
   B. Voltolyte.
   C. Electrolyte.

6. On the whole this story is about;

   A. Electrolyte.
   B. The function and care of batteries.
   C. How to use baking soda.

7. Why is it important to know about batteries?

   A. To know how to care for them.
   B. To tell others about batteries.
   C. To be able to repair them.

Answer the following:

1. What is electrolyte?

2. What are the four battery checks you should make regularly?

3. What must you do if you get battery acid on your skin?

4. Explain the hydrometer test.

Circle the correctly spelled word.

electrolite	electrolyte	electralite
neutralizes	nutrolizes	nutrelizes
acid	aced	asid
salferic	sulpheric	sulfuric
seperator	seperater	seporatar
hidramater	hydrometer	hidrometer
flash	fluch	flush
diapham	diagram	dyagram
complicated	comeplicated	comeplacated
termenal	terminal	termanal

True or False

_____1. The auto electrical system is the heart of the battery.

_____2. Electrolyte is made from water and sulfuric acid.

_____3. There are 5 battery checks you must make regularly.

_____4. Sulfuric eats holes in clothing.

_____5. Baking soda neutralizes the acid.

_____6. If you get acid in your eyes you must flush them with water and go to a doctor at once.

_____7. Sulfuric acid in a battery is harmful.

_____8. On a hydrometer test the lower the number the stronger the battery.

_____9. The two posts or terminals on a battery are called negative and positive.

_____10. Each cell in a battery produces 2 volts.

Instructions:

In the following article you will read about starting motors. There is also a vocabulary list that will help you understand the information better.

Instrucciones:

En el siguiente artículo vas a leer de la palanca de marcha automotriz. También hallaras una lista de vocabulario que te ayudará a entender la información mejor.

Vocabulary:

starter = spins the flywheel to start the engine.
palanca de marcha = da vuelta a rueda volante para poner en marcha el motor.

flywheel = heavy wheel operated by starter.
rueda volante = rueda que es operada por la palanca de marcha.

electromagnetism = flow of electricity through wires or winding.
electromagnetismo = corrido de electricidad por alambres.

armature = the movable part of an electromagnetic device.
armadura = parte movible de un diviso electromagnético.

commutator = a switch for reversing electric current.
conmutador = aparato para cambiar la corriente en una máquina dinamo eléctrica.

Remember the following questions as you read the article.

Recuerda las siguientes preguntas al leer el artículo.

1. What is the function of the starter?
   ¿Qué es la función de la palanca de marcha?

2. How does the starter work?
   ¿Cómo trabaja la palanca de marcha?

3. How is electromagnetism produced?
   ¿Cómo se produce electromagnetismo?

1. The starting motor or cranking motor or starter in a car performs one (1) function. It spins the flywheel to get the engine started. The starting motor is operated by electromagnetism. If you will remember, electricity flowing through wires and through coils of wire or windings produces electromagnetism. There are two (2) important points to remember about magnets when you study starting motors: 1. Like magnetic poles repel each other and 2. unlike magnetic poles attract each other.

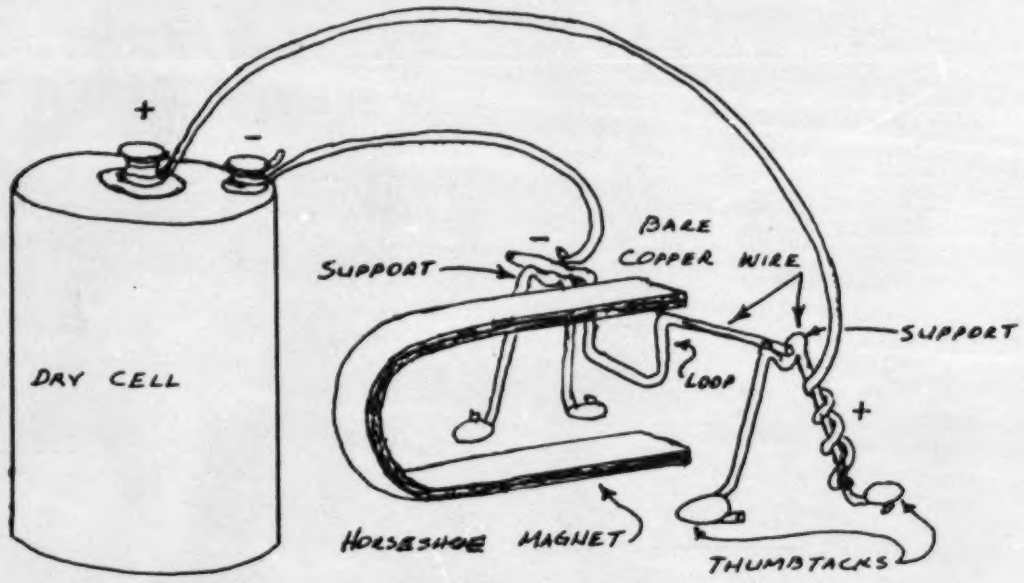
2. The two (2) major parts of a starting motor are the armature and the field frame assembly. There are other parts such as supports for the armature shaft, a drive gear, a solenoid switch, brushes, and a commutator, etc.

3. In simplified form this is what happens when you turn the key to start your car's engine. Current flows into the motor terminal and through the two field windings. From there it flows through one brush and then through the armature conductors to the other brush. This brush is connected to ground, which is the return circuit to the battery. The brushes make sliding contact with the armature commutator.

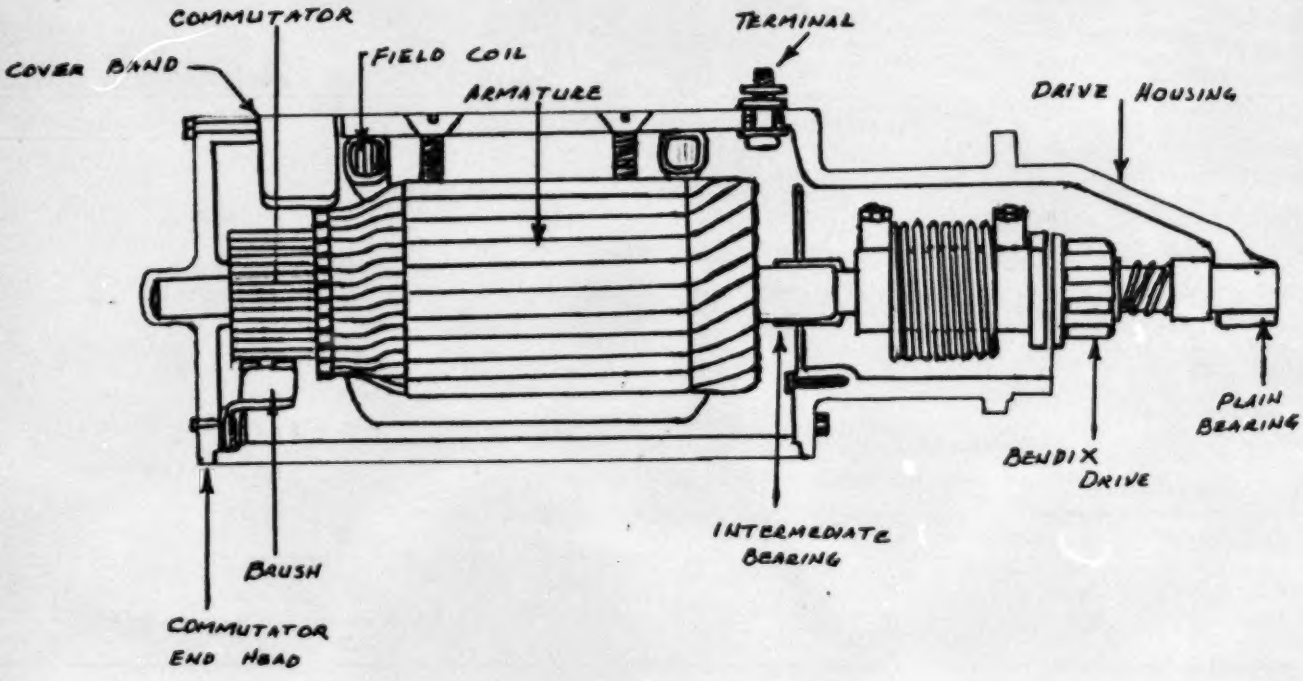
4. When current flows through the starting motor, a very strong magnetic field is produced by the field windings. Another powerful magnetic field is produced by the armature conductors. The winding magnetic field tries to push the armature magnetic field out of the way. The result is a powerful rotary push on the armature, which causes the armature to revolve. When the armature is connected to the engine flywheel through the meshing gears, it spins the engine crankshaft so that the engine starts.

5. The following diagram shows a simple arrangement to demonstrate motor principles. When the circuit is closed by touching the negative (−) wire to the support, the wire loop swings out from between the magnetic poles.

6. The second drawing is a cut-away view of a Bendix drive starting motor. Study both diagram closely. The next reading will discuss the Charging System.



Basic Principle of a Starter



Starting Motor

Find The Answer

1. The one function that the starter performs is;

   A. Supplies the electricity to the armature.
   B. Spins the flywheel.
   C. Produces electromagnetism.

2. The word in paragraph 2 that means "run by" is _____.

3. The words "flow into" in paragraph 4 refers to _____.

4. Like magnetic poles repel each other.

   Yes No Does not say

5. On the whole this story is about;

   A. How commutators work.
   B. The parts of a battery.
   C. How the starter works.

6. The story does not say so, but it makes you think that;

   A. There are four major parts of a starting motor.
   B. Starting motors are very important.
   C. Starting motors are very simple.

7. Why is it important to know about starters?

   A. To be able to replace them.
   B. To know how to repair them.
   C. To know about them.

Correct the punctuation and spelling of the following paragraph.

in simplafied form this is what happens when you turn the key to start your cars engine current flows into the motor termanal and through the two field winding from there it flaws thrugh one brash and them through the armatur conductors to the other brush this brush is connected to ground which is the return cercuit to the battery the brushes make sliding contact with the armature commutator

True or False.

_____1. The starting motor has two main parts.

_____2. Like magnetic poles attract each other.

_____3. Electromagnetism is produced when electricity flows through windings.

_____4. The starter performs one main function.

_____5. The starter spins the flywheel.

Draw a line separating the syllables in each word.

electromagnetism	_____
cranking	_____
supports	_____
armature	_____
commutator	_____
brushes	_____
solenoid	_____
powerful	_____
winding	_____
revolve	_____
starter	_____
repel	_____
principles	_____
negative	_____
Bendix	_____
current	_____
circuit	_____
contact	_____
conductors	_____
performs	_____

Put the following words in alphabetical order.

supports _____

electromagnetism _____

cranking _____

brushes _____

armature _____

solenoid _____

commutator _____

powerful _____

winding _____

circuit _____

revolve _____

starter _____

repel _____

negative _____

principles _____

current _____

Bendix _____

conductors _____

performs _____

contact _____

Instructions:

In the following information sheet you will be studying about the charging system. The list of words below will give you a background on the following information.

Instrucciones:

En la siguiente página de información vas a estudiar de el sistema de carga. La lista de palabras abajo te dará el fondo de la siguiente información.

Vocabulary:

alternator = puts back the current in the battery.
alternador = pone la corriente en el acumulador.

generator = puts back the current in the battery.
engendrador = pone la corriente en el acumulador.

regulator = regulates the electric current.
regulador= regula la corriente eléctrica.

Keep the following questions in mind as you read the article on the charging system.

Tenga a recuerdo las siguientes preguntas al leer el artículo en el sistema de carga.

1. What is the charging system of a car made of?
   ¿De qué está hecho el sistema de carga de un automóvil?

2. What is the job of the regulator?
   ¿Qué es el trabajo del regulador?

3. What is the difference between AC and DC current?
   ¿Cual es la diferencia entre corriente AC y DC?

4. What prevents the alternator or generator from burning?
   ¿Qué es lo que impede el alternador y engendrador de quemarse?

The Charging System

1. The charging system of a car is made up of the battery, the alternator or generator and the regulator. You have already studied about batteries in another section so now you will study alternators, generators and regulators.

2. When current is taken out of the battery, it has to be put back in or the battery will run down. This is the job that either the alternator or generator do in an automobile. When the engine is running fast enough, the alternator or generator takes over the job of supplying current to the entire electrical system. At the same time the alternator or generator puts current back into the battery so that it can again turn the cranking motor and do all the other jobs that require current.

3. Both the alternator and generator supply current but they do it in slightly different ways. Both produce alternating current (ac) that has to be converted to direct current (dc) because direct current is what automobiles use. The difference between ac and dc is that ac (the kind of current that homes, offices, schools and other biuldings use) flows first in one direction and then in the other, that is, it alternates. Direct current flows only in one direction.

4. As was mentioned before, the alternator and generator both produce electricity but they do it in slightly different ways. The alternator produces alternating current by the use of electromagnetic inductance. The best way to explain electromagnetic inductance is by demonstrating the effect a wire attached to an ammeter would have when passed through a horseshoe magnet. After inductance takes place, the ac current passes through diodes which convert the ac to dc. Diodes are like one-way valves. They will let current go through in one direction but will not let it go through in the opposite direction.

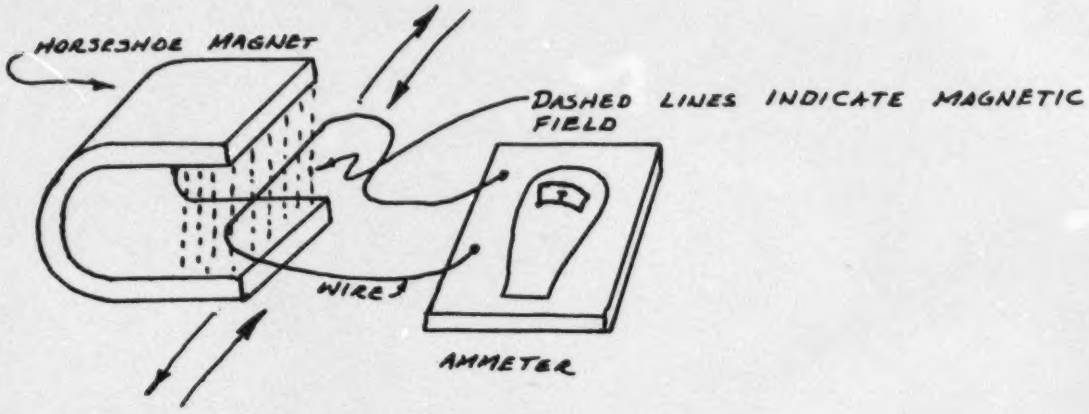
5. Generators use the same electromagnetic inductance principle as alternators to produce electricity. But to convert the ac to dc, generators use commutators and brushes. A simple way to explain this process is to visualize current, being inducted as the armature rotates around a magnetic field. As the ac current flows through the armature it goes through the commutator which revolves on two brushes. As it rotates on one brush, ac current goes through the brush flowing in one direction. As the armature rotates, it picks it up in the opposite brush again flowing in the same direction so that it has been converted to dc.

6. When a car's engine is running, the alternator or generator is producing current to supply the electrical system and replace the current that has been taken out of the battery. But what would happen if current were allowed to keep building up and building up? The alternator or generator would burn up. To prevent this, alternators and generators have regulators. The job the regulator has to do is fairly simple. It puts a resistance into the field circuit when the current starts to go too high. This resistance cuts down the amount of current flowing which reduces the strength of the magnetic field and the current that goes to the system and the battery.

7. Remember in another section it was mentioned that in an auto electrical system you have current, voltage and resistance? This is one area where resistance is used. The next information sheet will explain the most common problems of the automotive electrical system.

The Ammeter

4.5 (cont'd)



Find The Answer 4.5

1. What would happen if the current taken out of the battery was not put back in?

   A. Nothing
   B. The battery would be run down.
   C. The car would keep on running.

2. The word in paragraph 2 that means "work" is _____.

3. The words "supply current" refer to _____ or _____.

4. Both the alternator and generator supply current.

   Yes No Does not say

5. On the whole, this story is about

   A. Alternator and generator.
   B. Batteries.
   C. The parts and function of the charging system.

6. The story does not say so, but it makes you think that;

   A. A car could not work without the lighting system.
   B. The battery is the only part needed to turn the lights on.
   C. The charging system is very important because it supplies the current that is lost by the battery.

7. Why must the alternator or generator supply the current?

   A. Because the lights would not work.
   B. Because the battery would loose all its power.
   C. Because the regulator would burn out.

True or False

_____1. The charging system consists of the battery, alternator, or generator and lights.

_____2. When the current is taken out of the battery it has to be put back in or the battery will run down.

_____3. The alternator and generator both produce AC current.

_____4. AC is short for alternating current.

_____5. DC is current that flows first in one direction and then in the other direction.

_____6. If the current were allowed to build up the engine would burn up.

_____7. The job of the regulator is to put a resistance on the amount of current.

Circle the correctly spelled word.

altornate	alternate	allternate
convert	canvert	convart
ganerater	genarator	generator
alternator	alternater	allternater
regalater	regulator	regulater
resistance	resistence	recistance
indactance	inductance	inductence
principle	princaple	princpel

Match the following:

_____1. battery	A. put resistance on current.
_____2. regulator	B. limits amount of current flow.
_____3. alternator	C. alternating current
_____4. D.C.	D. produces alternating current.
_____5. A.C.	E. direct current
_____6. resistance	F. produces 12 volt current.

Correct the punctuation in the following paragraph:

The charging system of a car is made up of the battery the alternator or generator and regulator You have already studied about batteries in another section so now you will study alternators generators and regulators

Instructions:

In this information sheet you will be studying the problems of the electrical systems. The following vocabulary list will give you an idea as to what you will be studying in this information sheet.

Instrucciones:

En esta página de información vas a estudiar de las problemas de el sistema eléctrico. La siguiente lista de vocabulario te da una idea de lo que vas a estudiar en esta página de información.

Keep the following questions in mind as you read the information sheet.
Recuerda las siguientes preguntas al leer la pagina de información.

1. What is the most common cause of problems in an electrical system?
   ¿Cual es la causa más común de los problemas en un sistema eléctrico?

2. What are the six major steps for rebuilding a starting motor?
   ¿Cuáles son las seis fases básicas para re-construir un motor sobresalto?

3. What are the three common problems in the charging system?
   ¿Cuáles son los tres problemas comunes del sistema de cargar?

Problems of the Electrical Systems

1. By now you have read what electricity is, how it is produced, measured, the two types, and how it works to make an automobile run.

2. This section will explain some of the most common problems you may run into with an auto electrical system. Some problems having to do with the electrical system have already been discussed in previous sections so we will only go over them as a review.

3. The most common cause of problems in an electrical system is the battery. That is why it is so important to keep the proper water level in it and to keep the terminals clean. The next most common problem is the starter or starting motor.

4. If you try to start the car engine and nothing happens, turn your lights on. If you have no cranking and no lights, you either have a dead battery or a bad connection. Check the connections at the battery, the starting motor and the starter switch.

5. If the lights turn on but you still have no cranking and the lights dim slightly when you try to start, chances are the trouble is the starting motor. The same is true if the lights do not dim at all when you try to start the motor.

6. In most instances a starting motor that is considered worn or defective will be removed and replaced with a new starter. Nevertheless, the following are the six (6) major steps for rebuilding a starting motor:

    1. Replace bushings supporting the armature.
    2. Test the armature and the field coils.
    3. Turn the commutator if required.
    4. Replace the field coils if they are damaged.
    5. Check the solenoid.
    6. Replace the brushes.

7. There are three (3) common problems in the charging system of an automobile. They are:

    1. A loose or worn fan belt.
    2. A charged battery and a high charging rate.
    3. A discharged battery and a low charging rate.

8. If you have a charged battery and a high charging rate, other problems could result. The headlights could burn out and other electrical devices could be damaged. The battery would have a short life. More than likely, this trouble is in the regulator. Remove and replace the regulator.

9. If the battery is discharged and the alternator or generator is producing a low or no charging rate, check the fan belt. If the fan belt is alright, the trouble could be caused by a defective alternator or generator. Unless you have special training, the best thing to do is to remove and replace the alternator or generator.

10. By now you should be familiar with the auto electrical system. If there is something that is not quite clear, go back and review that section. If you still have difficulties consult with the instructor.

Find The Answers

1. What is the most common cause of problems in an electrical system?

   A. Commutator
   B. Battery
   C. Lights
   D. Broken armature

2. The word in paragraph 6 which means "to build again" is_____

3. The words "most common cause of problems" in paragraph 3 refers to _____.

4. The battery needs to be dry in order to run properly.

   Yes No Does not say

5. On the whole, this story is about;

   A. Problems in the gas tank.
   B. Problems of the electrical system.
   C. Problems in the solenoid.

6. The story does not say so, but it makes you think that;

   A. The headlights are part of the motor.
   B. The starter is the most common problem in the charging system.
   C. A battery can cause problems in the electrical system as well as in the charging system.

7. What is the third step in rebuilding a starting motor?

   A. Check the solenoid.
   B. A loose or worn fan belt.
   C. Turn the commutator if required.

Match the following:

_____1. Replace brushings supporting the armature.

_____2. If you have no cranking and no lights.

_____3. Check the solenoid.

_____4. Most common cause of problems in an electrical system.

_____5. Loose or worn fan belt.

_____6. No cranking but lights turn on and dim slightly when you try to start.

A. battery

B. trouble in the starting motor.

C. First major step in rebuilding a starting motor.

D. dead battery.

E. Common problem in charging system.

F. Fifth major step in rebuilding a starting motor.

Answer the following questions:

1. What are the three common problems in the charging system?

2. What problems would result if you have a charged battery and a high charging rate?

3. What do you check if the battery is discharged and the alternator or generator if producing a low or no charging rate?

4. What are the common problems or cause of problems in an electrical system?

Arrange the following words in alphabetical order.

electricity	_____
terminals	_____
connection	_____
slightly	_____
electrical	_____
switch	_____
armature	_____
engine	_____
starter	_____
battery	_____
commutator	_____
headlights	_____
solenoid	_____
alternator	_____
regulator	_____

POST-TEST

1. Name the five groups that make up the electrical system.

2. What is electrolyte and what must you do if you get it on your skin?

3. What is the charging system made up of?

4. Name the three common problems of a charging system.

5. Describe how electricity is produced.

6. What three jobs must the electrical system do?

7. What is the function of the starting motor?

8. What are AC and DC?

9. How and what is used to measure electricity?

10. What are the four battery checks you must make regularly?

11. What are the two major parts of a starting motor?

12. Name the six major steps for rebuilding a starting motor.